EARNING DOWNSIDE RISK AND THE SIGNIFICANCE OF ESG PERFORMANCE IN THE PRIMARY ECONOMIC SECTOR

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ABSTRACT

This study explores the impact of corporate sustainability measured by environmental, social, and governance (ESG) performance on earning downside risk (EDR). We focus on the role of ESG performance in moderating firms' earning downside risk (EDR), especially in uncertain economic times. The economic uncertainty is evidenced by the recent global crisis of COVID-19. We conducted a multivariate regression analysis by utilising a large dataset from Refinitiv, covering 48 countries over fourteen years. Our findings revealed a significant negative association between ESG performance and EDR, suggesting that higher ESG performance correlates with reduced accounting downside risk. The analysis further demonstrates that the environmental and social components of ESG, closely aligned with the United Nations Global Compact Core Principles, play a crucial role in mitigating the adverse impact of the COVID-19 crisis, particularly in the primary economic sector. These results provide novel insights into the importance of sustainable practices in enhancing corporate resilience during times of global economic uncertainty.

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1. INTRODUCTION

The recent worldwide economic uncertainty, intensified by the COVID-19 pandemic, has disrupted multiple economic sectors. Prior literature extensively documents that adherence to environmental and social ideals fosters cautious and efficient investing conduct in corporations. The global crisis has given rise not only to significant health-related issues but also concerns regarding the sustainable and social issues of poverty, hunger, lack of clean water and sanitation, poor healthcare systems, education, and economy (Heggen et al., 2020). According to the World Development Report (World Bank, 2022), the crisis reversed decades of global poverty reduction and worsened inequality. Survey data revealed that temporary unemployment was 70% higher among primary-educated workers across most countries, while youth, women, and informal workers experienced disproportionate income losses. Subsequently, these fundamental issues have caused an alarming global economic recession. Compared to the prior crisis that was primarily a result of financial matters, the current global crisis is caused by inimitable social issues. There was a sudden onset of market-wide financial crisis in the beginning months of 2020, in which the consequences are more comparable to the great depression of 1929–1933 than the 2008 global financial crisis (Broadstock et al., 2021). This unique occurrence has raised essential questions and initiated novel opportunities to contribute to the literature on sustainability and ESG (environmental, social, and governance).

Hence, this leads to a central question of this study: Does sustainable performance matter in this uncertain period? From the perspective of accounting downside risk, these questions remain largely unanswered, with research on the role of ESG performance during crisis times from the accounting risk perspective is somewhat limited. Some initial literature reveals that high-ESG portfolios outperform low-ESG portfolios and ESG performance alleviates financial risk during a financial crisis (Broadstock et al., 2021; Xu et al., 2023; Cardillo et al., 2023; Omura et al., 2021; Liu et al., 2023). Furthermore, firms with sustainable strategies on environmental issues demonstrate better stock returns (Garel & Petit-Romec, 2021). However, these studies focused on a particular market, such as China, or specific sustainability issues, such as environmental. Moreover, the majority of recent studies focus mainly on the stock market (e.g., Broadstock et al., 2021; Rahman et al., 2021; Sun et al., 2021; Takahashi & Yamada, 2021). Therefore, our study attempts to shed light on a global scale by utilising comprehensive measures of ESG on firm-level data and exploring the impact from the perspective of accounting-based downside risk.

This study investigates the influence of corporate sustainability performance measured by the social, environmental, and governance performance on firms' earning downside risk, especially during the current uncertain economic environment. The analysis specifically focuses on the primary economic sector defined as companies categorised under the basic materials sector. This study was conducted at a global scale by utilising a Refinitiv large dataset. The sample covered 48 countries with a total of 25,827 observations across fourteen years. As supported by the literature, the study expects that higher corporate sustainable performance will reduce excessive risk and moderate the impact of the crisis.

The utilisation of accounting data in measuring downside risk presents a distinct advantage. While market-based measures depend on stock prices or market valuations, accounting-based measures draw on financial statement data, offering insights into earnings variability, cash flow

fluctuations, and changes in financial ratios. This aspect is particularly pertinent for firms that are not publicly traded as they lack extensive market data. Furthermore, the reliance on accounting data enables a long-term outlook, in contrast to market data which can be disproportionately influenced by transient market sentiments and fluctuations. This approach diverges from traditional risk assessment methods, which often consider both positive and negative volatility by specifically targeting the downside risk: the probability and impact of negative returns or financial losses. This perspective aligns more closely with the concerns of investors and managers who are predominantly focused on the potential for loss rather than the variability of returns.

In sum, the current global crisis poses formidable challenges to firms across various economic sectors. This research endeavours to provide a comprehensive understanding of how these challenges manifest particularly in the primary sector and the potential moderating role of sustainable performance. By addressing these objectives, this research seeks to contribute valuable insights to businesses, policymakers, and stakeholders aiming to navigate the turbulent waters of global crises while fostering sustainability and resilience.

2. LITERATURE REVIEW AND HYPOTHESIS

2.1. *The Impact of COVID-19 on Corporations and ESG Performance*

The COVID-19 pandemic has had a profound effect on sustainability research and the pursuit of the Sustainable Development Goals (SDGs), offering valuable insights into the obstacles and possibilities that have arisen in this particular situation. A number of empirical research (e.g., Leal Filho et al., 2021; Pradhan et al., 2021) have examined the influence of the pandemic on sustainability research and the pursuit of SDGs.

The study by Leal Filho et al. (2021) revealed that 82% of researchers experienced interruptions as a result of the lockdowns, with 52% reporting disruptions lasting for a duration of 1 to 2 months. Meanwhile, Pradhan et al. (2021) examined the potential effects of the pandemic on different SDGs in Nepal by employing a knowledge co-creation approach involving experts from varied professional fields. The findings emphasise that the pandemic has had an adverse immediate effect on the majority of SDGs, with targets concerning poverty, education, gender equality, economic growth, industry, inequality, sustainable cities, and climate action facing weak to moderate degrees of constraining consequences. However, they also uncovered potential modestly beneficial effects for several targets of SDGs 2, 3, 6, and 11. Ultimately, both studies highlight the significant and diverse influence of COVID-19 on sustainability research and the effort to achieve SDGs.

The COVID-19 pandemic has had a significant impact on stock markets worldwide. Sun et al. (2021) found that the Chinese stock market was negatively affected by a specific incident. Rahman et al. (2021) observed an initial negative market response to the announcement of the pandemic, followed by a positive reaction to the "JobKeeper" stimulus package. Yu & Luu (2021) investigated the variations in ESG disclosure among prominent organisations in various countries and discovered that the level of ESG disclosure was mostly driven by the attributes of the firms.

Furthermore, COVID-19 has created a distinctive and difficult situation for worldwide financial markets, leading to a considerable emphasis on the importance of ESG performance in the ability of companies to withstand and recover from the crisis. A comprehensive analysis by Broadstock et al. (2021) specifically examined the ESG performance of China's CSI300 members to understand its impact amidst the financial crisis caused by the pandemic. It was revealed that COVID-19 provides a distinct opportunity to assess the efficacy of ESG investments in comparison to their non-ESG counterparts.

Research on corporate ESG performance on the stock market during the pandemic has shown a positive correlation between social scores and stock returns (Liu et al., 2023). Enhanced corporate governance and environmental responsibility have been found to have a significant impact on stock market prices. ESG performance has been found to function as an "equity vaccine" to enhance stock prices during economic decline (Xu et al., 2023). Companies with higher ESG scores have shown superior performance during public notifications of COVID-19 incidents. Socially Responsible Investment (SRI) indices and ESG funds have also shown effectiveness during the pandemic (Cardillo et al., 2023).

The COVID-19 pandemic has also highlighted the significance of ESG performance in corporate operations. Several literature reviews have examined the precise elements of ESG performance during the pandemic, with a particular emphasis on sustainability initiatives, practices of disclosing information, and their influence on the value and risk of companies. For instance, Yoo et al. (2021) investigated the impact of ESG performance on the fluctuations in stock returns and volatility that occurred during the financial crisis triggered by the COVID-19 pandemic. Meanwhile, Bose et al. (2022) examined how COVID-19 affected changes in the value of companies and the extent to which the sustainability performance of these companies influenced this relationship. Wang et al. (2023) explored the correlation between ESG performance and the likelihood of a company experiencing a crash using a spillover network approach. Whereas, the research by Jin et al. (2023) investigated the efficacy of ESG disclosure in mitigating the risks associated with COVID-19, while Garel & Petit-Romec (2021) had looked on the relationship between the adoption of responsible environmental efforts by enterprises and their stock returns throughout the crisis.

The above studies emphasise the crucial importance of ESG performance in reducing risks and maintaining the value of companies amidst the COVID-19 issue. They highlight the significance of environmental sustainability, transparent reporting of ESG information, and a company's focus on creating value for stakeholders as crucial elements that enhance a firm's ability to withstand financial crises. The focus of prior studies is summarised in Table 1.

Table 1: ESG and Risk Literature

Aspects	Prior Studies	Citation
Geographic Scope	Focused on single countries (e.g., China, Japan) or specific regions.	Broadstock et al. (2021); Xu et al. (2023)
Sectoral Focus	Primarily examined financial markets or aggregated sectors.	Takahashi & Yamada (2021)
Risk Measurement	Relied on market-based metrics (e.g., stock volatility).	Yoo et al. (2021)
ESG Disaggregation	Often treated ESG as a monolithic score without analyzing sub-components.	Rahman et al. (2021)
Crisis Context	Studied financial crises (e.g., 2008) or pre-pandemic periods.	Garel & Petit-Romec (2021)
Methodological Rigor	Limited addressing of endogeneity (e.g., simultaneity between ESG and performance).	Alam et al. (2021)

In contrast, our study advances prior research by addressing the key limitations and furthering new insights. Previous studies mostly focused on a single market like China (Broadstock et al., 2021; Xu et al., 2023) or specific regions. Our study expands this by covering 48 countries, thus providing a global perspective on ESG's risk-mitigation role. While financial sector and stock market reactions are well-studied (Takahashi & Yamada, 2021; Rahman et al., 2021), we shift focus by concentrating on the under-examined primary economic sector (basic materials), which is particularly vulnerable to COVID-19 supply chain disruptions. In terms of methodology, we expand beyond market-based risk metrics by employing accounting-based downside risk (EDR). This provides novel evidence of the ESG-EDR relationship. The analysis disaggregates scores into ESG components, revealing that environmental and social factors matter more than governance in crisis periods. We also expand the crisis context by covering the COVID-19 period and testing on the sensitivity of the 2008 financial crisis. Finally, we address endogeneity concerns through the two-stage least squares (2SLS) model with country-industry-adjusted ESG scores and lead-lag models, overcoming methodological limitations in earlier studies.

2.2. *Accounting-based Downside Risk*

Accounting-based downside risk metrics are increasingly being used in accounting and finance research to assess corporate risk and financial stability. These metrics provide a comprehensive evaluation of a company's operational well-being, revealing its financial robustness and weaknesses. They are crucial in academic research, enabling the exploration of corporate finance decisions, risk management, and decision-making processes. They are used in comparative assessments across industries and geographies, providing a nuanced perspective in situations where market data may be insufficient or deceptive.

Multiple studies have shown that accounting-based downside risk metrics are useful for evaluating the risk and performance of companies in different situations. They provide highly

valuable perspectives on the interaction between accounting metrics, corporate governance, macroeconomic elements, and market opinions, emphasising the complex nature of risk in today's business environment.

Konchitchki et al. (2016) identified a significant link between firms' risk exposure and potential for lower profitability, underscoring its relevance in predicting future operational outcomes. Companies with high downside earnings risk tend to struggle more with performance and are more sensitive to macroeconomic shifts. Building on this, Alam et al. (2021) introduced the cash flow downside risk (CFDR) metric, which showed stronger explanatory power for credit spread variations than earnings downside risk. Similarly, Luo et al. (2021) observed a positive relationship between earnings downside risk and expected stock returns in China, primarily driven by accrual-based components. This pricing effect is more pronounced in firms with transparent reporting and sound governance. Contrarily, Ali et al. (2022) reported a negative relationship between strong corporate governance and both downside and upside risks in Australian firms, thus challenging the assumption that governance reduces risk asymmetrically. Their method, which accounts for endogeneity and sectoral governance variations, contributes to the robustness of the results and raises critical questions about the role of governance in risk and value management.

Consequently, the discussion of literature leads to the postulation of three main hypotheses, which are aligned with the objectives of this study. The first hypothesis is as follows:

H1: ESG performance is negatively associated with earning downside risk.

Evidenced by the negative implications of COVID-19, we expect that ESG performance can moderate the impact of COVID-19 on earning downside risk. Hence, Hypotheses 2 and 3 are as follows:

H2: ESG performance reduces the positive association of COVID-19 and earning downside risk.

H3: ESG performance reduces the positive association of COVID-19 and earning downside risk for the primary economic sector.

3. METHODOLOGY

3.1. Data

This study utilised data from Refinitiv Eikon Datastream and the World Bank Database, with Eikon and Datastream are the main sources of comprehensive data encompassing accounting and ESG, while World Bank serves as the primary data source for economic and governance indicators at the country level. The unbalanced panel spans 2008 to 2021. Initially, the ESG dataset included 7,027 listed firms with 52,257 observations. Financial firms were excluded due to their distinct characteristics, reducing the sample to 6,403 firms (47,996 observations) which exclusively comprised of counties that have a minimum of two companies. Next, the accounting risk variables were combined with the main control variables. The final sample consisted of 3,613 companies from 48 countries, resulting in 25,827 firm-year observations. The number of

companies and observations for each nation in the sample is listed in Table 2 of Section 4.1. The dataset exhibited notable variability in firm-level characteristics such as profitability, leverage, and sales growth, reflecting heterogeneity in firm size, industry, and geography. To address the influence of outliers, the study applied winsorization at the 1st and 99th percentiles to minimise distortion from extreme values without arbitrarily dropping observations. According to Tukey (1977), winsorizing at 1st/99th percentiles assumes that extreme values beyond these bounds are likely non-representative. The selection of the thresholds is also consistent with prior literature in earning downside risk (Konchitchki et al., 2016; Alam et al., 2021). Maintaining consistency with established thresholds ensures our results are directly comparable to the broader literature on downside risk.

3.2. Empirical Strategy

This study employed multiple regression analysis to analyse the relationship between earning downside risk and ESG performance, alongside its significance during the global crisis. The main empirical model for testing this relationship is as follows:

$$EDR_{it} = \alpha_0 + \beta_1 ESG_{it} + \beta_2 (ESG_{it} \times COVID_t) + \beta_3 (ESG_{it} \times COVID_t \times PRIMARY_i) + \beta_4 COVID_t + \beta_5 (COVID_t \times PRIMARY_i) \times + \sum_{i=1}^{n} \beta_i Controls_{it} + YearFE + IndustryFE + \varepsilon_{it}$$
(1)

Where EDR_{it} accounts for earning downside risk and ESG_{it} is the primary score for the overall ESG performance obtained from Refinitiv. We also tested the three main subcomponents of ESG: ENSCORE, SOSCORE, and CGSCORE. These are the measures of environmental, social, and governance scores, respectively. $COVID_t$ is defined by an indicator variable for the COVID-19 year, which is 1 for 2019 and 2020 and 0 otherwise. $ESG_{it} \times COVID_t$ and $ESG_{it} \times COVID_t \times PRIMARY_i$ are the interactions between these variables to capture the moderating role of ESG during COVID-19 and the impact specifically for the primary sector. $Controls_{it}$ is a list of the identified firm and country observable determinants of accounting risk, while *YearFE* and *IndustryFE* are the year and industry fixed effects, respectively. The definition of the variables is discussed below in detail. All tests used robust regressions and were clustered by the firm to exploit information in the cross-sectional and time-series nature of the data and to control for heteroskedasticity and the serial correlation in the firm's time-series observations.

3.3. Dependent Variable: Accounting-based Downside Risk

Following Konchitchki et al. (2016), we measured earning downside risk EDR in two steps. First, we determined the expected level of earnings by estimating the following earnings expectation model:

$$ROA_{it} = \alpha_0 + \alpha_1 ROA_{it-1} + \alpha_2 SALE_{it-1} + \alpha_3 SIZE_{it-1} + \alpha_4 LEVERAGE_{it-1} + \alpha_5 STDROA_{it-1} + \alpha_6 OC_{it-1} + \varepsilon_{it}$$
(2)

Where ROA is defined as the ratio of EBIT (earnings before interest and taxes) to total assets; SALE is the quotient obtained by dividing total revenues with total assets; SIZE refers to the firm's size based on the natural logarithm of its market value of equity; LEVERAGE is the

leverage ratio determined by dividing total debts with total assets; STDROA represents the standard deviation of the return on assets (ROA) calculated over the previous 3-5 fiscal years, if the data is accessible; and OC refers to the operating cycle, which is measured as the natural logarithm of 360 days multiplied by the ratio of accounts receivable to total revenues. The fitted value from Eq. (2) represents expected earnings while the estimated residual, $\hat{\varepsilon}_{it}$, indicates the deviations below ($\hat{\varepsilon}_{it} < 0$) or above or equal to ($\hat{\varepsilon}_{it} \geq 0$) the expectation. By using a root lower partial moment analysis, EDR construction can be expressed as follows:

$$
EDR_{it} = \log \left\{ \frac{1 + \left[\left(\frac{1}{N} \right) \sum (\hat{\varepsilon}_{it} \times I\hat{\varepsilon}_{it} < 0)^2 \right]^{1/2}}{1 + \left[\left(\frac{1}{N} \right) \sum (\hat{\varepsilon}_{it} \times I\hat{\varepsilon}_{it} \geq 0)^2 \right]^{1/2}} \right\}
\tag{3}
$$

Where N is the total number of residuals; $I\hat{\varepsilon}_{it} < 0$ is an indicator that equals to one if $\hat{\varepsilon}_{it} < 0$ and zero otherwise, indicating the realised ROA is below its expected level; and $I\hat{\varepsilon}_{it} \geq 0$ is an indicator that equals to one if $\hat{\varepsilon}_{it} \geq 0$ and zero otherwise. We estimated Eq. (2) using ordinary least squares (OLS) regressions for NAICS industries over 3-year rolling windows after winsorizing all input variables at the 1st and 99th percentiles of their sample distributions. Then, we used the residuals to compute EDR according to Eq. (3).

3.4. Main Control Variables

A set of primary control variables was determined by analysing existing research. (1) PROFITABILITY is quantified by the ratio of earnings before interest and taxes (EBIT) to the total value of assets adjusted with industry country average. The inclusion of profitability as the primary control variable accounts for variations in management quality. This is because it can be argued that the high volatility of a company's returns may be attributed to inadequate management skills rather than excessive risk-taking (Faccio et al., 2011). (2) SIZE refers to the natural logarithm of the total assets of the firm. (3) LEVERAGE is quantified by the proportion of total debt to total assets. (4) SALES is the measure of sales growth represented by the natural logarithm of sales. (5) AGE is determined by taking the natural logarithm of (1 + the number of years since incorporation). This variable will account for variations in the lifespan of a company as it is anticipated that the likelihood of uncertainty for a company decreases as it becomes older (Faccio et al., 2011). (6) The variable BIG4 is a binary indicator that takes the value of 1 if the auditing firm is one of the four major audit corporations, namely Deloitte, Price Waterhouse, Ernst & Young, and KPMG. It is anticipated that companies associated with one of the four major audit firms will exhibit superior accounting quality and reduced uncertainty. (7) GDPG is GDP growth determined by calculating the difference in estimated GDP per capita of a specific country using prices from the year 2005 as a constant. Given that the sample consists of many nations, this variable will serve as a means to account for the level of economic development in each country, which can have an indirect impact on the uncertainty of firms' returns. (8) FCF is calculated as the ratio of free cash flow to the total assets. (9) INFLATION is measured by the consumer price index. (10) Regulatory quality (REGQ) is a country governance variable that measures the government's ability to formulate and implement sound policies and regulations that allow and support private sector development. This variable is expressed as a percentile rank

and indicates the country's rank among all countries, with a rank of 0 corresponding to countries with the lowest regulatory quality and 100 to countries with the highest regulatory quality.

4. RESULTS AND DISCUSSION

4.1. *Univariate Analysis*

Table 2 reports the list of countries with the distribution of observations. The sample includes 3,613 firms with 25,827 observations and at least two firms from a maximum of 48 countries. However, three countries represent a significant fraction of the sample: the United States (24.68%), Japan (19.65%), and China (9.77%).

Table 2: List of Countries in the Sample

No.	Country	Firms Number	Obs.	No.	Country	Firms Number	Obs.
1	Australia	137	1,129	25	Luxembourg	13	53
2	Austria	8	42	26	Malaysia	91	258
3	Belgium	16	138	27	Mexico	17	77
4	Brazil	42	345	28	Morocco	2	15
5	Canada	133	1,203	29	Netherlands	28	245
6	Chile	25	242	30	New Zealand	11	107
7	China	605	2,524	31	Norway	17	73
8	Colombia	8	60	32	Panama	2	6
9	Czech Republic	2	25	33	Peru	17	84
10	Denmark	22	151	34	Philippines	9	71
11	Egypt	11	52	35	Poland	13	96
12	Finland	22	103	36	Portugal	5	40
13	France	79	565	37	Russia	13	112
14	Germany	130	988	38	Saudi Arabia	34	138
15	Greece	9	74	39	Singapore	17	156
16	Hong Kong	105	995	40	South Africa	43	392
17	Iceland	2	4	41	Spain	33	269
18	India	79	369	42	Sweden	79	365
19	Indonesia	24	135	43	Switzerland	56	386
20	Ireland; Republic of	20	185	44	Thailand	50	234
21	Israel	9	61	45	Turkey	25	130
22	Italy	43	210	46	United Kingdom	198	1,447
23	Japan	416	5,076	47	United States of America	883	6,375
24	Kuwait	3	11	48	Vietnam	7	11
					Total	**3,613**	**25,827**

Note: This table presents the country distribution of firms and firm-year observations in our sample.

Table 3 shows the descriptive statistics for the main variables used in the analysis. The first line presents the descriptive of the dependent variables, followed by the measures of ESG and the main control variables. The descriptive results show that the average ESG scores are 45% for overall performance, 39% for environment (ENSCORE), 44% for social (SOSCORE), and 51% for governance (CGSCORE). These scores indicate that the performance of firms is somewhat average with a slight concentration on the governance score. Environment scores the lowest compared to social and governance, which might signal corporate struggles in achieving environmental sustainability. For other control variables, the results indicated that 84% of the firms are audited by a BIG4 auditor and that most of the firms are big corporations as evidenced by the high mean value for SIZE.

Table 3: Descriptive Statistics

Full Sample				Primary Sector			
Variables	Mean	Median	Std. Dev.	Variables	Mean	Median	Std. Dev.
EDR	-0.062	-0.058	0.112	EDR	-0.079	-0.065	0.126
ESG	0.445	0.437	0.208	ESG	0.457	0.462	0.219
ENSCORE	0.391	0.386	0.286	ENSCORE	0.444	0.469	0.272
SOSCORE	0.437	0.417	0.245	SOSCORE	0.416	0.387	0.251
CGSCORE	0.509	0.515	0.222	CGSCORE	0.535	0.550	0.223
PROFITABILITY	0.208	0.080	0.294	AdjROA	0.253	0.081	0.344
SIZE	15.223	15.231	1.601	SIZE	15.169	15.271	1.506
LEVERAGE	0.253	0.240	0.181	LEVERAGE	0.260	0.257	0.168
SALEG	0.029	0.050	0.244	SALEG	0.027	0.044	0.275
LnAGE	3.525	3.466	0.777	LnAGE	3.588	3.555	0.832
BIG4	0.838	1.000	0.368	BIG4	0.823	1.000	0.382
FCF	0.067	0.068	0.142	FCF	0.057	0.065	0.182
GDPG	1.438	1.540	3.236	GDPG	1.508	1.533	3.219
INFLATION	1.829	1.640	1.693	INFLATION	2.049	1.812	1.865
REGQ	82.550	89.423	17.880	REGQ	79.932	88.942	20.197
UAI	57.131	48.000	23.327	UAI	57.954	49.000	22.567

Note: This table presents descriptive statistics for the variables employed in our analyses. All continuous variables are winsorized at the 1st and 99th percentiles.

Table 4 presents the Pearson correlation coefficient for the test and main control variables. The results indicated that all ESG scores are negatively correlated with EDR, which agrees with our hypotheses. The control variables are correlated with the dependent variables in a way that is generally consistent with the prior literature. For instance, PROFITABILITY, SIZE, BIG4, and AGE are all negatively associated with EDR as expected, while both leverage and regulatory quality are positively correlated with EDR. The significant correlation between the control and dependent variables indicates the importance of controlling these variables in the multivariate test. Overall, the correlations among the independent variables are within acceptable limits and reject the possibility of multicollinearity.

Table 4: Pearson Correlation

	EDR	ESG	ENSCORE	SOSCORE	CGSCORE	PROFITABILITY	SIZE	LEVERAGE
EDR	1							
ESG	-0.0931*	1						
ENSCORE	-0.0369*	0.8636*	1					
SOSCORE	-0.0866*	0.9059*	0.7221*	1				
CGSCORE	-0.0913*	0.6625*	0.3803*	0.4182*	1			
PROFITABILITY	-0.2473*	-0.0494*	-0.1585*	0.0374*	0.0075	1		
SIZE	-0.0940*	0.4748*	0.5359*	0.3809*	0.2575*	-0.1561*	1	
LEVERAGE	0.0773*	0.0939*	0.1034*	0.1039*	0.0446*	-0.0548*	0.2499*	1
SALEG	-0.0319*	-0.0501*	-0.0678*	-0.0424*	-0.0151*	0.0852*	0.002	-0.0462*
LnAGE	0.0148*	0.1657*	0.2429*	0.1055*	0.0374*	-0.1856*	0.1847*	-0.0868*
BIG4	-0.0644*	0.2253*	0.1849*	0.2369*	0.1338*	0.0926*	0.2002*	0.0781*
FCF	-0.4885*	0.0514*	0.0312*	0.0367*	0.0367*	0.1919*	0.0725*	-0.1225*
GDPG	-0.0140*	-0.0903*	-0.0943*	-0.1187*	0.0109	-0.0772*	0.0244*	-0.0209*
INFLATION	-0.0768*	-0.0367*	-0.0956*	0.0016	0.0211*	0.0390*	-0.1018*	0.0312*
REGQ	0.0665*	0.0910*	0.0607*	0.1530*	0.0116	0.2843*	-0.0812*	-0.0246*
UAI	0.0865*	0.1243*	0.2264*	0.0668*	-0.0411*	-0.3036*	0.2046*	-0.0161*

	SALEG	LnAGE	BIG4	FCF	GDPG	INFLATION	REGQ	UAI
SALEG	1							
LnAGE	-0.0683*	1						
BIG4	-0.0520*	0.0521*	1					
FCF	0.1886*	0.0604*	0.0198*	1				
GDPG	0.1838*	-0.1471*	-0.1766*	0.0693*	1			
INFLATION	0.0848*	-0.1547*	-0.1264*	0.0667*	0.2831*	1		
REGQ	-0.0442*	0.0994*	0.3455*	-0.0767*	-0.3740*	-0.3018*	1	
UAI	-0.0730*	0.4083*	0.0936*	-0.0135*	-0.2718*	-0.2917*	0.0891*	1

Note: This table presents the Pearson correlation matrix of the variables employed in our analyses. All continuous variables are winsorized at the 1st and 99th percentiles. The statistical significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***.

4.2. Multivariate Analysis

4.2.1. Main Results: The Role of ESG Performance during the Global Crisis

The multivariate regression analysis results presented in Table 5 suggest that there is a significant negative association between ESG and EDR. Column 1 shows the results from a pooled OLS regression whereby the main variable of interest (ESG) is hypothesised to have a negative association with earning downside risk (EDR). The estimated coefficient on ESG (-0.021) is negative and statistically significant at 1%. This finding is consistent with our first hypothesis (H1) and suggests that higher ESG performance is associated with a decrease in firm accounting downside risk. The explanatory power of our model (adjusted R-squared = 32%) is much higher compared to prior relevant studies (e.g., Yoo et al., 2021).

To further explore the impact of ESG performance on EDR during the COVID-19 global crisis, we interacted the variable ESG with COVID. Finally, to uncover the precise impact on the primary economic sector, we interacted ESG-COVID with PRIMARY, the indicator for the primary economic sector. The interaction variables, ESG*COVID and ESG*COVID*PRIMARY, showed significant negative coefficients of 0.020 and -0.051, respectively. These findings are consistent with Hypotheses 2 and 3 (H2 and H3). On the other hand, COVID-19 has a significantly positive impact on the primary economic sector (COVID*PRIMARY = 0.033). it denotes that COVID-19 accelerates higher earning downside risk. Collectively, these results provide robust evidence that higher ESG performance is associated with a significantly lower earning downside risk and that ESG performance can moderate the severity of the COVID-19 crisis.

To expand more meaningful input to the analysis, we further tested on the ESG sub-scores. These tests revealed the vital components of ESG scores that contribute to lower downside risk and play a significant moderating role during the global crisis. The results presented in Table 5 (Columns 2, 3, and 4) show that both ENSCORE*COVID*PRIMARY and SOSCORE*COVID*PRIMARY are negative, which significantly moderates the positive impact of COVID-19 on earning downside risk. In contrast, CGSCORE*COVID*PRIMARY is insignificant. The results revealed that environmental and social performance are the two important ESG factors that contribute to lower potential of losses during the COVID-19 global crisis for the primary economic sector.

The environmental (ENSCORE) and social (SOSCORE) components of ESG are more effective than governance (CGSCORE) in mitigating downside risk during crises, signalling stakeholder resilience and crisis adaptation. On the other hand, governance mechanisms (e.g., board oversight, executive incentives) are designed for long-term stability but lack agility in acute crises. Firms with strong environmental and social practices will foster stakeholder trust, which becomes critical during systemic shocks. Prior studies found that investors tend to reward firms with high environmental and social performance. Albuquerque et al. (2020) reported that non-financial firms with higher environmental and social impact scores demonstrate higher returns and lower return volatilities. Meanwhile, Garel & Petit-Romec (2021) found that firms with responsible strategies on environmental issues experience higher stock returns during the COVID-19 crisis. In contrast, firms with low environmental performance are high risk and more vulnerable during the crisis as investors are demanding compensation (higher return) for their exposure to

environmental issues (Bolton & Kacperczyk, 2023). Overall, our findings align with emerging post-pandemic research and are supported by the theoretical lens.

Table 5: Main Analysis: The role of ESG during COVID-19 for Primary Sector

	(1) EDR	(2) EDR	(3) EDR	(4) EDR
ESG	-0.021***			
	(-2.82)			
ESG*COVID	-0.020**			
	(-2.13)			
ESG*COVID*PRIMARY	-0.051*			
	(-1.84)			
ENSCORE		0.001		
		(0.11)		
ENSCORE*COVID*PRIMARY		-0.019***		
		(-3.02)		
ENSCORE*COVID		-0.037*		
		(-1.72)		
SOSCORE			-0.018***	
			(-2.89)	
SOSCORE*COVID			-0.014*	
			(-1.95)	
SOSCORE*COVID*PRIMARY			-0.051**	
			(-2.26)	
CGSCORE				-0.018***
				(-3.02)
CGSCORE*COVID				-0.015*
				(-1.71)
CGSCORE*COVID*PRIMARY				-0.031
				(-1.13)
COVID	0.011*	0.008	0.009	0.009
	(1.79)	(1.45)	(1.62)	(1.43)
COVID*PRIMARY	0.033**	0.025*	0.030**	0.025
	(1.96)	(1.94)	(2.20)	(1.36)
PROFITABILITY	-0.061***	-0.062***	-0.062***	-0.062***
	(-7.20)	(-6.76)	(-6.73)	(-6.77)
SIZE	-0.005***	-0.006***	-0.004***	-0.005***
	(-4.11)	(-4.27)	(-3.57)	(-4.21)
LEVERAGE	0.024***	0.025***	0.025***	0.025***
	(2.84)	(2.88)	(2.87)	(2.80)
SALEG	0.026***	0.025***	0.025***	0.025***
	(3.72)	(3.36)	(3.30)	(3.31)
LnAGE	0.000	-0.001	-0.000	-0.000
	(0.09)	(-0.25)	(-0.11)	(-0.23)
BIG4	-0.014***	-0.017***	-0.016***	-0.017***
	(-2.97)	(-3.55)	(-3.22)	(-3.44)
FCF	-0.355***	-0.355***	-0.354***	-0.355***
	(-10.04)	(-9.30)	(-9.31)	(-9.30)

GDPG	0.002***	0.003***	0.002***	0.003***
	(5.15)	(5.52)	(4.86)	(5.55)
INFLATION	-0.002**	-0.002***	-0.001**	-0.002**
	(-2.46)	(-2.58)	(-2.00)	(-2.46)
REGQ	0.001***	0.001***	0.001***	0.001***
	(6.01)	(5.70)	(5.93)	(5.74)
UAI	0.000***	0.000***	0.000***	0.000***
	(3.90)	(3.74)	(3.65)	(3.39)
(intercept)	0.014	0.018	0.001	0.019
	(0.69)	(0.88)	(0.06)	(1.03)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
R-sq	0.320	0.321	0.323	0.323
adj. R-sq	0.320	0.320	0.322	0.322
N	25827	24281	24275	24282

Note: This table presents the OLS estimates of the effect of ESG on earning downside risk (EDR). Column 1 is the overall measure of ESG. Column 2 until 4, the ENSCORE, SOSCORE, and CGSCORE are the scores for the environmental, social and governance component respectively. COVID is the indicator variable for the COVID-19 year (2019-2020), PRIMARY is the indicator variable for the primary economic sector. The t-statistics in parentheses are based on heteroskedasticity robust standard errors, clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. The statistical significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***.

4.2.2. *United Nations Global Compact Core Principles*

Additionally, we delved into the constituents of ESG and pinpointed three supplementary ESG ratings that are closely aligned with the United Nations Global Compact Core Principles and Sustainable Development Goals (SDGs). The variables under examination are the indicators of labour rights (ESGSOCOS), human rights (ESGSOWOS), and environment (ESGENRRS).

First, the labour rights variable was quantified by the workforce category score, which assessed a company's proficiency in promoting job satisfaction, thus ensuring a healthy and safe workplace, fostering diversity and equal opportunities, and providing development prospects for its employees. This measure aligns with SDG 8 (Decent Work) and SDG 5 (Gender Equality). Second, the community category score measures a company's commitment to being a responsible citizen, safeguarding public health, and upholding commercial ethics, hence serving as an indicator of its human rights performance. This indicator aligns with SDG 3 (Good Health) and SDG 16 (Peace and Justice). Finally, the environmental variable was quantified by the resource utilisation category score, which indicates a company's ability to decrease the consumption of materials, energy, or water and to discover more environmentally friendly solutions through enhanced supply chain management. This variable endorses SDG 12 (Responsible Consumption) and SDG 13 (Climate Action).

The findings in Table 6 show that all of these measures indicate a significant impact towards reducing the possibility of losses in the main economic sector during the worldwide COVID-19 crisis. It suggests the ESG-SDG linkage is consistent and relevant, particularly during the crisis. Sadiq et al. (2022) highlighted that environmental score, social score, governance score, and economic growth are positively associated with achieving the countries' SDGs. The significant negative association between the three measures of ESG-SDG scores in our findings demonstrate

how these specific SDG factors stabilised earnings during supply chain disruptions. Hence, prioritising these six SDGs (i.e., SDG 3, SDG 5, SDG 8, SDG 12, SDG 13, and SDG 16) could enhance corporate crisis resilience, especially during uncertain times.

Table 6: United Nation Global Compact Core Principles

	(1) EDR	(2) EDR	(3) EDR
ESGSOCOS	-0.022***		
	(-4.35)		
ESGSOCOS*COVID	-0.001		
	(-0.26)		
ESGSOCOS*COVID*PRIMARY	-0.046***		
	(-2.63)		
ESGSOWOS		-0.015***	
		(-3.04)	
ESGSOWOS*COVID		-0.012*	
		(-1.83)	
ESGSOWOS*COVID*PRIMARY		-0.047*	
		(-1.89)	
ESGENRRS			-0.009**
			(-2.05)
ESGENRRS*COVID			-0.017***
			(-3.18)
ESGENRRS*COVID*PRIMARY			-0.031*
			(-1.77)
COVID	0.001	0.008	0.008*
	(0.29)	(1.36)	(1.68)
COVID*PRIMARY	0.028**	0.032*	0.023**
	(2.42)	(1.92)	(1.97)
PROFITABILITY	-0.056***	-0.064***	-0.063***
	(-6.07)	(-6.94)	(-6.86)
SIZE	-0.004***	-0.005***	-0.005***
	(-3.58)	(-3.79)	(-3.59)
LEVERAGE	0.026***	0.025***	0.025***
	(2.99)	(2.81)	(2.82)
SALEG	0.024***	0.025***	0.025***
	(3.24)	(3.38)	(3.30)
LnAGE	-0.000	-0.000	-0.000
	(-0.21)	(-0.17)	(-0.09)
BIG4	-0.016***	-0.016***	-0.016***
	(-3.29)	(-3.32)	(-3.34)
FCF	-0.357***	-0.353***	-0.354***
	(-9.32)	(-9.29)	(-9.30)
GDPG	0.002***	0.002***	0.002***
	(4.70)	(5.06)	(5.10)
INFLATION	-0.001	-0.002**	-0.002**
	(-1.49)	(-2.23)	(-2.42)
REGQ	0.001***	0.001***	0.001***
	(6.11)	(5.75)	(5.80)
UAI	0.000***	0.000***	0.000***

	(3.53)	(3.57)	(3.69)
(intercept)	0.003	0.009	0.003
	(0.16)	(0.48)	(0.17)
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
R-sq	0.324	0.323	0.322
adj. R-sq	0.323	0.322	0.321
N	24275	24275	24281

Note: This table presents the OLS estimates of the effect of ESG on earning downside risk (EDR). These are the ESG ratings that closely align with the United Nations Global Compact Core Principles. Column 1 until 3 are the measure of labour rights (ESGSOCOS), human rights (ESGSOWOS), and environment (ESGENRRS). COVID is the indicator variable for the COVID-19 year (2019-2020), PRIMARY is the indicator variable for the primary economic sector. The t-statistics in parentheses are based on heteroskedasticity robust standard errors, clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. The statistical significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***.

4.3. Robust Analyses

4.3.1. Addressing endogeneity issue: two-stage least squares model

In this line of study,[1] there is a possible bidirectional causality between ESG and measures of company's financial performance. Company's performance on ESG can contribute to financial performance and vice versa. Such a factor creates simultaneity in the relationship; hence, a regular OLS estimation will lead to spurious results. This study addressed the possible endogeneity issue using the 2SLS model. In particular, the relationship between the ESG performance of the PRIMARY economic sector with EDR was tested in two stages. In the first stage, the endogenous variable (ESG) was regressed on the instrument, including the exogenous independent variables. The second stage used the predicted value of ESG from the first-stage regression as the independent variable of interest. We extracted the exogenous component of ESG by constructing an instrumental variable (IV) that captured the natural trend of ESG across all firms involved in similar types of activities and locations. For this purpose, the study followed the methodology in Abu Bakar et al. (2023) and used the fraction of ESG firm's performance to all firms in the same country and industry as the instrument (IV) for ESG. These variables capture the country-industry effect, which is not directly related to EDR. Additionally, we used the country-industry adjusted ESG scores to derive the interaction variables. The results demonstrated that the findings are consistent with the primary model, thus eliminating the possibility of endogeneity in the estimation.

4.3.2. Addressing interval impact: lead-lag model

Financial events that impact the unpredictability of returns may arise towards the conclusion of the fiscal year. To assess the potential effects that may arise throughout the specified time period, this study also performed a test using the lag of the ESG performance and all control variables. Our findings demonstrate a constant relationship between ESG performance and EDR. Concerning the impact of ESG performance on EDR during the COVID-19 global crisis, the lag of interaction variables, ESG*COVID and ESG*COVID*PRIMARY, show significant negative

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[1] The study involving ESG or sustainability and Corporate Social Responsibility (CSR).

coefficients. Hence, this relationship remains substantial even when considering the potential influence over the interval period. By incorporating the delayed value, the analysis provides additional evidence against the occurrence of endogeneity resulting from simultaneity. The data offers compelling evidence of consistent findings and enhances the primary estimation employed.

4.4. Other Sensitivity Tests

We also conducted other sensitivity tests to assess the robustness of our results by considering additional control variables for the main model. This includes controlling the impact of country governance, national culture, and the 2008 global financial crisis.

The influence of other country governance: The primary estimation incorporates regulatory quality as a key control variable to account for the level of governance in the country where the firm operates. As per the World Governance Indicator (WGI), governance refers to the established customs and institutions that regulate the procedure by which governments are selected, supervised, and substituted. The index assesses the government's ability to develop and execute effective policies alongside the level of respect shown by both public and government officials for the institutions. There are six factors assessing a country's governance: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. These metrics assess the efficacy of official organisations in regulating the economic and social transactions within the country that impact business performance. In the final test, we systematically varied five other metrics of country governance to assess the impact on our estimation. The results indicated that the findings are consistent across all models.

The influence of national culture: The primary estimation control for Uncertainty Avoidance Index (UAI) measures the discomfort and unease individuals experience when faced with uncertainty. We further tested the sensitivity of the results by incorporating another three main measures of Hofstede national culture that related to risk taking behaviour: Power Distance Index (PDI), Individualism versus Collectivism (IDV), and Masculinity versus Femininity (MAS). Power Distance Index (PDI) measures the degree to which individuals in a society are willing to accept an unequal distribution of power. In Individualism versus Collectivism (IDV), individualism represents an intimately interconnected social structure, while collectivism emphasises a robust social structure. Meanwhile, Masculinity versus Femininity (MAS) measures the differences between cultures that emphasise toughness and tenderness. The analysis was conducted autonomously to avoid the presence of multicollinearity. The results demonstrated that the findings are uniform across all models.

The impact of global financial crisis: This study addressed the influence of financial crisis on the main findings by identifying the crisis year (2008-2009) and its interaction with the overall ESG performance and the indicator for PRIMARY economic sector. The findings showed that the impact of the interaction between crisis and ESG is insignificant, but the impact of ESG on EDR during the crisis period for the PRIMARY sector is significant and negative. Such a finding is consistent with the main estimation. The results also demonstrated the influence of ESG performance that can moderate the impact of crisis on downside risk.

5. CONCLUSION

This paper examined the impact of the global COVID-19 crisis and the role of ESG performance on the downside risk of companies within the primary economic sector. The study focuses on the primary economic sector defined as companies categorised under the basic materials sector and utilises accounting data to measure downside risk.

This research contributes significantly to the understanding of the dynamics of crisis impact on the primary economic sector and the moderating role of sustainable performance. The findings clearly indicate that higher corporate ESG performance is associated with lower earning downside risk, particularly during the COVID-19 global crisis. This highlights the importance of sustainable practices in business operations, not just as a moral or regulatory compliance but as a strategic tool for risk mitigation. Environmental and social factors, in particular, were found to be influential in reducing the potential for losses during the crisis. These findings navigate a perspective for ESG prioritisation. By anchoring these results with the stakeholder theory and "ESG-Crisis Hypothesis", we provide a standpoint for the evaluation of how non-financial metrics interact with financial resilience in turbulent economics. These insights are invaluable for businesses, policymakers, and stakeholders, underscoring the need to integrate sustainable practices into corporate strategy to enhance resilience in the face of global crises. Regulators, especially in emerging economies, can incentivise SDG-aligned ESG practices to attract stability-seeking investors.

Future studies can be expanded in terms of the market focus by using alternative measures of financial and non-financial metrics and further exploring the dynamics of the ESG-crisis relationship. While our global sample includes emerging economies, future studies can explicitly compare ESG's risk-mitigation effects in developed versus emerging markets, where informal sectors and regulatory heterogeneity may alter the outcomes. The measurement of economic uncertainty is limited to the indicator variable based on the year of COVID-19 and the financial crisis. Hence, future research can explore using different and more complex measures of uncertainty. The study's approach, using comprehensive ESG measures and accounting-based downside risk, also sets a new direction for evaluating corporate performance and risk in times of global economic uncertainty. Our use of accounting-based EDR (versus market-based measures) invites research into other non-financial risk indicators, such as supply-chain ESG compliance scores or community trust indices, which may predict crisis resilience. Future research can also build on these findings by examining the dynamic long-term effects of sustainable practices on corporate performance and exploring other sectors affected by similar crises. Longitudinal studies can track how ESG's protective effects evolve across crisis types.

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REFERENCES

Abu Bakar, N., Abdelsalam, O., Taamouti, A., & Elmasry, A. (2023). The market uncertainty of ethically compliant equity: An integrated screening approach. Journal of International Financial Markets, Institutions & Money, 86, 101759. https://doi.org/10.1016/j.intfin.2023.101759

Alam, P., Hettler, B., & Gao, H. (2021). Accounting downside risk measures and credit spreads. *Review of Accounting and Finance*, *20*(1), 103–120. https://doi.org/10.1108/RAF-08-2020-0244

Albuquerque, R., Koskinen, Y., Yang, S., & Zhang, C. (2020). Resiliency ofenvironmental and social stocks: An analysis of the exogenous COVID-19 market crash. T*he Review of Corporate Finance Studies*, 9(3), 593–621. https://doi.org/10.1093/rcfs/cfaa011

Ali, S., Liu, B., & Su, J. J. (2022). Does corporate governance have a differential effect on downside and upside risk? *Journal of Business Finance and Accounting*, *49*(9–10), 1642–1695. https://doi.org/10.1111/jbfa.12606

Bose, S., Shams, S., Ali, M. J., & Mihret, D. (2022). COVID-19 impact, sustainability performance and firm value: international evidence. *Accounting and Finance*, *62*(1), 597–643. https://doi.org/10.1111/acfi.12801

Broadstock, D. C., Chan, K., Cheng, L. T. W., & Wang, X. (2021). The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Finance Research Letters*, *38*(August 2020), 101716. https://doi.org/10.1016/j.frl.2020.101716

Cardillo, G., Bendinelli, E., & Torluccio, G. (2023). COVID-19, ESG investing, and the resilience of more sustainable stocks: Evidence from European firms. *Business Strategy and the Environment*, *32*(1), 602–623. https://doi.org/10.1002/bse.3163

Faccio, M., Marchica, M. T., & Mura, R. (2011). Large shareholder diversification and corporate risk-taking. *Review of Financial Studies*, *24*(11), 3601–3641. https://doi.org/10.1093/rfs/hhr065

Garel, A., & Petit-Romec, A. (2021). Investor rewards to environmental responsibility: Evidence from the COVID-19 crisis. *Journal of Corporate Finance*, *68*(March), 101948. https://doi.org/10.1016/j.jcorpfin.2021.101948

Heggen, K., Sandset, T. J., & Engebretsen, E. (2020). COVID-19 and sustainable development goals. In *Bull World Health Organ* (Issue 98). https://doi.org/10.1504/IJSD.2020.112182

Jin, Y., Liu, Q., Tse, Y., & Zheng, K. (2023). Hedging Covid-19 risk with ESG disclosure. *International Review of Economics and Finance*, *88*(June), 27–46. https://doi.org/10.1016/j.iref.2023.06.002

Konchitchki, Y., Luo, Y., Ma, M. L. Z., & Wu, F. (2016). Accounting-based downside risk, cost of capital, and the macroeconomy. *Review of Accounting Studies*, *21*(1), 1–36. https://doi.org/10.1007/s11142-015-9338-7

Leal Filho, W., Azul, A. M., Wall, T., Vasconcelos, C. R. P., Salvia, A. L., do Paço, A., Shulla, K., Levesque, V., Doni, F., Alvarez-Castañón, L., Mac-lean, C., Avila, L. V., Damke, L. I., Castro, P., Azeiteiro, U. M., Fritzen, B., Ferreira, P., & Frankenberger, F. (2021). COVID-19: the impact of a global crisis on sustainable development research. *Sustainability Science*, *16*(1), 85–99. https://doi.org/10.1007/s11625-020-00866-y

Liu, L., Nemoto, N., & Lu, C. (2023). The Effect of ESG performance on the stock market during the COVID-19 Pandemic — Evidence from Japan. *Economic Analysis and Policy*, *79*, 702–712. https://doi.org/10.1016/j.eap.2023.06.038

Luo, Y., Wang, X., Zhang, C., & Huang, W. (2021). Accounting-based downside risk and

expected stock returns: Evidence from China. *International Review of Financial Analysis*, *78*(October), 101920. https://doi.org/10.1016/j.irfa.2021.101920

Omura, A., Roca, E., & Nakai, M. (2021). Does responsible investing pay during economic downturns: Evidence from the COVID-19 pandemic. *Finance Research Letters*, *November*, 101914. https://doi.org/10.1016/j.frl.2020.101914

Pradhan, P., Subedi, D. R., Khatiwada, D., Joshi, K. K., Kafle, S., & Chhetri, R. P. (2021). The COVID-19 pandemic not only poses challenges, but also opens opportunities for sustainable transformation. *Earth's Future*, *9*. https://doi.org/10.1029/2021EF001996

Rahman, M. L., Amin, A., & Al Mamun, M. A. (2021). The COVID-19 outbreak and stock market reactions: Evidence from Australia. *Finance Research Letters*, *38*(August 2020), 101832. https://doi.org/10.1016/j.frl.2020.101832

Sadiq, M., Ngo, T. Q., Pantamee, A. A., Khudoykulov, K., Ngan, T. T., & Tan, L. P. (2023). The role of environmental social and governance in achieving sustainable development goals: Evidence from ASEAN countries. Economic Research-Ekonomska Istraživanja, *36*(1), 170–190. https://doi.org/10.1080/1331677X.2022.2072357

Sun, Y., Wu, M., Zeng, X., & Peng, Z. (2021). The impact of COVID-19 on the Chinese stock market: Sentimental or substantial? *Finance Research Letters*, *38*(November 2020), 101838. https://doi.org/10.1016/j.frl.2020.101838

Takahashi, H., & Yamada, K. (2021). When the Japanese stock market meets COVID-19: Impact of ownership, China and US exposure, and ESG channels. *International Review of Financial Analysis*, *74*(February), 101670. https://doi.org/10.1016/j.irfa.2021.101670

Tukey, J. W. (1977). Exploratory Data Analysis. Addison-Wesley. https://doi.org/10.1002/bimj.4710230408

Wang, L., Ji, Y., & Ni, Z. (2023). Spillover of stock price crash risk: Do environmental, social and governance (ESG) matter? *International Review of Financial Analysis*, *89*(99). https://doi.org/10.1016/j.irfa.2023.102768

Xu, N., Chen, J., Zhou, F., Dong, Q., & He, Z. (2023). Corporate ESG and resilience of stock prices in the context of the COVID-19 pandemic in China. *Pacific Basin Finance Journal*, *79*(December 2022), 102040. https://doi.org/10.1016/j.pacfin.2023.102040

Yoo, S., Keeley, A. R., & Managi, S. (2021). Does sustainability activities performance matter during financial crises? Investigating the case of COVID-19. *Energy Policy*, *155*(March), 112330. https://doi.org/10.1016/j.enpol.2021.112330

Yu, E. P. Yi, & Luu, B. Van. (2021). International variations in ESG disclosure – Do cross-listed companies care more? *International Review of Financial Analysis*, *75*(March), 101731. https://doi.org/10.1016/j.irfa.2021.101731